*भारतीय मानक*
***Indian Standard***

**IS 5088 : 2022**

# वस्त्रादि — गोला बारूद के लिये सूती वस्त्रादि — विशिष्टि

*( दूसरा पुनरीक्षण )*

# Textiles — Cotton Textiles for Ammunition — Specification

*( Second Revision )*

ICS 59.080.30



भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली –110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002
www.bis.gov.in www.standardsbis.in

**September 2022** **Price Group 6**

Man-Made Fibres, Cotton and their Products Sectional Committee, TXD 31

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Man-Made Fibres, Cotton and their Products Sectional Committee had been approved by the Textiles Division Council.

This standard was originally published in 1969 and was subsequently revised in 1982 to align it with the requirements of JSS-1-69-02(b) and JSS 1266 issued by the Ministry of Defence, Government of India. In the first revision, Part I — Fabrics used in the manufacture of propellant charges and other purposes ( based on J S S 1258 ); and Part II — Cotton drill olive green proofed used in the manufacture of Bandoliers ( Based on J S S 1268 ) were amalgamated into this standard. The standard has again been revised to incorporate the following changes:

a) All Amendments have been incorporated
b) BIS certification marking clause has been modified.
c) References to Indian Standards have been updated.
d) Sampling plan has been modified.

The composition of the Committee responsible for the formulation of this standard is given in Annex D.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

**IS 5088 : 2022**

*Indian Standard*

# TEXTILES — COTTON TEXTILES FOR AMMUNITION — SPECIFICATION

*( Second Revision )*



## 1 SCOPE

**1.1** This standard prescribes the constructional details and other requirements of nine varieties of cotton fabrics used in ammunition.

**1.2** This standard does not specify the general appearance, feel, etc, of the cloth (*see also* **4.3**).

## 2 REFERENCES

The standards listed in Annex A contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of these standards.

## 3 MANUFACTURE

**3.1 Yarn** — The cotton yarn used in the manufacture of the cloth shall be satisfactory in evenness and reasonably free from neps and other spinning defects.

**3.2 Cloth** — The cloth shall be free from dressing and filling materials and substances liable to increase mass or cause subsequent tendering.

**3.2.1** The olive green drill shall be thoroughly shrunk.

**3.2.2** The cloth shall be dyed with suitable dyes to shades as agreed to between the buyer and the sellers (*see* Note). In case of olive green shade the cloth shall be dyed with vat dyes in conjunction with iron and chromium salts (mineral khaki).

NOTE — Sulphur dyes shall not be used for dyeing the cloth.

**3.2.3** The bleached cloth shall have a full bleached finish and shall be free from blueing or optical whitening agents.

**3.2.4** The selvedges shall be firm and straight. In case of olive green drill, the selvedges shall be woven either with reverse draft or with plain ends of a maximum of 6 mm width to prevent curling.

**3.2.5** The dyed cloth shall not develop acidity on ageing or liable to tendering. The cloth when kept in contact with non-ferrous metals, shall not promote corrosion.

**3.2.6** The cloth when visually examined shall be reasonably free from spinning, weaving and processing defects.

**3.2.7** The dye used for dyeing shall be compatible to explosives.

## 4 REQUIREMENTS

**4.1** The constructional particulars of the cloth shall conform to those given in Table 1 excepting the count of warp and weft yarn which have been given for guidance only.

NOTE — For testing the conformity of various requirements given in Tables 1 and 2, the test specimen shall be conditioned in standard atmosphere of 65 ± 2 percent relative humidity and 27 ± 2°C temperature (*see* IS 6359) and tested in the standard atmosphere.

**Table 1 Constructional Particulars of Cotton Fabrics for Ammunition**

(*Clause* 4.1)

| **Variety No.** | **Type** | **Approximate Count of Yarn** (Cotton Count (tex)) | | **Ends per cm** *Min* | **Picks per cm** *Min* | **Mass** g/m$^2$ | **Breaking Strength on 5 × 20 cm Strip,** N (kgf), *Min* | | **Length,** m, *Min* | **Width,** cm | **Weave** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Warp | Weft | | | | Warp | Weft | | | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| 1 | Drill (Olive green dyed) | 14s (42) | 12s (50) | 38 | 19 | >260 | 1075 (110) | 625 (64) | 20 | 91 | 3/1 Warp faced twill |
| 2 | Cambric (Bleached or dyed) | 60s (10) | 60s (10) | 40 | 32 | 60 – 75 | 215(22) | 145 (15) | 20 | 91 | Plain |
| 3 | Calico (Bleached) | – | – | 30 | 30 | >145 | 300 (31) | 300 (31) | 20 | 91 | Plain |
| 4 | Calico (Bleached) | 36s (16.5) | 36s (16.5) | 40 | 39 | >135 | 430 (44) | 400 (41) | 20 | 91 | Plain |
| 5 | Calico | – | – | 36 | 30 | 60 – 72 | 300 (31) | 180 (19) | 20 | 91 | Plain |
| 6 | Drill | – | – | 39 | 13 | >290 | 860 (88) | 800 (82) | 20 | 91 | 3/1 Warp faced twill |
| 7 | Calico (Bleached) | – | – | 27 | 27 | 160 – 180 | 380 (39) | 290 (30) | 20 | 91 | Plain |
| 8 | Cambric | – | – | 23 | 20 | 35 – 45 | 130 (14) | 65 (6) | 20 | 91 | Plain |
| 9 | Drill calico | 12s (50) | 10s (60) | 35 | 20 | >270 | 590 (61) | 590 (61) | 20 | 91 | 3/1 Warp faced twill |
| | | | | | | | | | or as agreed | | |
| Tolerance, Percent | | — | — | — | — | — | — | — | — | ± 2 | — |
| Method of Test | | — | — | ← IS 1963→ | | IS 1964 | ← IS 1969 (Part 1) → | | ← IS 1954 → | | Visual |

NOTES

**1** Fabrics for covers and other fabrics for rubber proofing shall be free from copper, manganese and their compounds when tested as per IS 1039.

**2** If the cloth variety No. 6 is supplied in the loom state, the requirements given in Table 2 are not applicable.

**4.2** The colour fastness ratings and other requirements of the cloth shall conform to those given in Table 2.

**Table 2 Chemical Requirements of Cotton Fabrics for Ammunition**
(*Clause* 4.2)

| Sl No. | Characteristic | Requirement | Method of Test |
|---|---|---|---|
| (1) | (2) | (3) | (4) |
| i) | Colour fastness to light (Dyed fabrics only) (*see* Note) | 5 or better | IS/ISO 105-B01 or IS/ISO 105-B02 |
| ii) | Colour fastness to washing (Dyed fabrics only) | 4 or better | IS/ISO 105-C10 [Test Number B (2)] |
| iii) | Colour fastness to Nitrogen Oxides (Variety no. 8 only) | 5 or better | IS/ISO 105-G01 |
| iv) | Scouring loss, percent, *Max* | 2.0 | IS 1383 |
| v) | *p*H value | | IS 1390 |
| | a) Olive green drill | 5.5 to 9.5 | |
| | b) Other fabrics | 5.5 to 8.5 | |
| vi) | Shrinkage or elongation, percent, *Max* | | IS 2977 |
| | a) Olive green drill | 2.0 | |
| | b) Other fabrics | 4.0 | |
| vii) | Water soluble chlorides as sodium chloride, percent, *Max* | | IS 4202 |
| | a) Olive green drill | 0.1 | |
| | b) Other fabrics | 0.05 | |
| viii) | Water soluble sulphates as sodium sulphate, percent, *Max* | | IS 4203 |
| | a) Olive green drill | 0.50 | |
| | b) Other fabrics | 0.25 | |

**Table 2 (Contd.)**

(*Clause* 4.2)

| Sl No. | Characteristic | Requirement | Method of Test |
|---|---|---|---|
| (1) | (2) | (3) | (4) |
| ix) | Sulphur and sulphur compounds as sulphur (for other fabrics), percent, *Max* | 0.01 | C-1 |
| x) | Water soluble chromates, as sodium chromate, percent, *Max* (for olive green drill) | 0.1 | IS 5449 |
| xi) | Soda soluble chromium compounds, as sodium chromate ($Na_2CrO_4$), percent, *Min* (for olive green drill) | 0.07 | IS 5449 |
| xii) | Iron and chromium compounds, as $Fe_2O_3$ and $Cr_2O_3$, percent, *Min* (for olive green drill) | 1.5 | IS 4655 |
| xiii) | Ash content, percent, Max | | IS 199 |
| | a) Other fabrics except olive green drill | 0.5 | |
| | b) For variety No. 5 | 1.0 | |
| xiv) | Moisture regain, percent, *Max* | 9.0 | IS 199 |
| xv) | Lead and compounds of lead calculated as metallic lead, percent, *Max* (when required as free from lead by agreement) | 0 03 | C-2 |
| xvi) | Matter extractable by ether, percent, *Max* (for variety No. 9) | 0.5 | IS 4390 |
| xvii) | Fatty acid or similar acids extractable by ether, as oleic acid, acid, percent, *Max* (for variety No. 9) | 0.25 | IS 4390 |
| xviii) | Water extractable matter, percent, *Max* | 1.0 | IS 3456 |

NOTE — In case of dispute, the colour fastness to light shall be determined by the method prescribed in IS/ISO 105-B01.

**4.3 Sealed Sample** — If in order to illustrate or specify the general appearance, feel, etc, of cloth, a sample has been agreed upon and sealed, the supply shall be in conformity with the sample in such respects.

**4.3.1** The custody of the sealed sample shall be a matter of prior agreement between the buyer and the seller.

## 5 PACKING

**5.1** Unless otherwise specified, the cloth shall be packed in bales or cases in conformity with the procedure laid down in IS 1347 or IS 293 as required.

## 6 MARKING

**6.1** The cloth shall be marked with the following information:

a) Name of the material and variety no.;
b) Length and width of the piece;
c) Month and year of manufacture;
d) Manufacturer's name, initials or trade-mark, if any.

**6.1.1** *BIS Certification Marking*

e product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations framed thereunder, and the product(s) may be marked with the Standard Mark.

## 7 SAMPLING

**7.1** The lot shall consist of all the bales/packs of cloth delivered to a buyer against one despatch note.

**7.2** Unless otherwise sampling plan is specified in the contract or order, the sampling plan as given in Table 3 may be used for inspecting and testing of cloth against this standard. The number of rolls to be selected from the lot for assessing manufacture and workmanship (*see* **3.1** and **3.2**) and testing width, ends, picks and weight shall be as per col 2 of Table 3. The number of test specimens to be selected for other tests shall be in accordance with col 4 of Table 3. To ensure the randomness of selection, IS 4905 may be followed.

**Table 3 Sampling Plan for Cotton Fabrics for Ammunition**
(*Clause* 7.2 *and* 7.3)

| **Sl No.** | **Lot Size** | **Sample Size** | **Permissible No. of Defectives Samples** | **Sub-Sample Size** (to be drawn from sample) | **Permissible No. of Defectives Sub-Samples** |
|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) |
| i) | 2 to 25 | 3 | 0 | 3 | 0 |
| ii) | 26 to 90 | 13 | 1 | 3 | 0 |
| iii) | 91 to 150 | 20 | 2 | 13 | 1 |
| iv) | 151 to 280 | 32 | 3 | 13 | 1 |
| v) | 281 to 500 | 50 | 5 | 20 | 1 |
| vi) | 501 to 1 200 | 80 | 7 | 32 | 2 |
| vii) | 1 201 and above | 125 | 10 | 50 | 3 |

NOTE −− If sample size equals or exceeds lot size, carry out 100 percent inspection.

### 7.3 Criteria for Conformity

The lot shall be declared conforming to the requirements of this standard if the total number of defective samples does not exceed the permissible numbers given in col 3 or col 5 of Table 3 as applicable.

## ANNEX A
(*Clause* 2)

## LIST OF REFERRED INDIAN STANDARDS

| *IS No.* | *Title* |
|---|---|
| 199 : 1989 | Textiles — Estimation of moisture, total size or finish, ash and fatty matter in grey and finished cotton textile materials (*third revision*) |
| 293 : 1980 | Code for seaworthy packaging of cotton yarn and cloth (*third revision*) |
| 1039 : 1989 | Textiles — Estimation of small quantities of copper, iron, manganese, chromium and zinc (*first revision*) |
| 1347 : 1972 | Specification for inland packaging of cotton cloth and yarn (*first revision*) |
| 1383 : 1977 | Methods for determination of scouring loss in grey and finished cotton textile materials (*first revision*) |
| 1390 : 2022 | Textiles — Determination of *p*H of aqueous extract (*third revision*) |
| 1954 : 1990 | Determination of length and width of woven fabrics — Methods (*second revision*) |
| 1963 : 1981 | Methods for determination of threads per unit length in woven fabrics (*second revision*) |
| 1964 : 2001 | Textiles — Methods for determination of mass per unit length and mass per unit area of fabrics (*second revision*) |
| 1969 (Part 1) : 2018 | Textiles — Tensile properties of fabrics — Part 1 Determination of maximum force and elongation at maximum force using the strip method (*fourth revision*) |
| 2977 : 1989 | Fabrics (other than wool) — Method for determination of dimensional changes on soaking in water (*first revision*) |
| 3456 : 2022 | Method for determination of water soluble matter of textile Materials (*first revision*) |
| 4202 : 2022 | Method for determination of chloride content of textile Materials (*First Revision*) |
| 4203 : 2022 | Method for determination of sulphate content of textile Materials (*First Revision*) |
| 4390 : 2001 | Textiles — Method for estimation of solvent soluble matter in textile material (*first revision*) |
| 4655 : 1968 | Method for determination of iron and chromium in textiles |
| 4905 : 2015 | Random sampling and randomization procedures (*first revision*) |
| 5449 : 2022 | Methods for determination of water soluble chromate in textile Materials (*First Revision*) |
| 6359 : 1971 | Method for conditioning of textiles |
| IS/ISO 105-B01:2014 | Textiles — Tests for colour fastness — Part B01 Colour fastness to light: Daylight |
| IS/ISO 105-B02:2014 | Textiles — Tests for colour fastness — Part B02 Colour fastness to artificial light: Xenon arc fading lamp test |
| IS/ISO 105-C10:2006 | Textiles — Tests for colour fastness Part C10 Colour fastness to washing with soap or soap and soda |
| IS/ISO 105-G01 : 2016 | Textiles — Tests for colour fastness Part G01 Colour fastness to nitrogen oxides |

## ANNEX B
(*Informative*)

## END USE OF COTTON FABRICS FOR AMMUNITION

| *Variety No.* | *End Use* | *Variety No.* | *End Use* |
|---|---|---|---|
| 1 | Bandoliers | 5 | For tail and muzzle covers |
| 2 | Bags for propellent cordite charges | 6 | For B. L. & Q. F. drill cortridge |
| 3 | Propellent bags and miscellaneous uses | 7 | For TNT bags |
| 4 | Straining purposes for the manufacture of mercury fulminate and lead azide | 8 | — |
| | | 9 | For light TNT and CE bags. |

## ANNEX C
(*Table* 2)

## METHODS OF TESTS

### C-1 DETERMINATION OF SULPHUR AND SULPHUR COMPOUNDS

**C-1.1 Principle** — The dyed fabric is treated with zinc and hydrochloric acid and the stain produced on lead acetate paper by the hydrogen sulphide liberated from the day is compared with that produced by known quantities of sodium sulphide under identical conditions of test.

**C-1.2 Reagents**

**C-1.2.1** *Standard Sodium Sulphide Solution*

**C-1.2.1.1** Dissolve 0.244 g of sodium sulphide of the analytical reagent grade in distilled water in a 1 000-ml standard flask and make up to the mark. One ml of this solution is equivalent to 0.1 mg of sulphur.

**C-1.2.2** *Lead Acetate Papers*

**C-1.2.2.1** Prepare 100 ml of a 5 percent *w/v* aqueous solution of normal lead acetate in a 250-ml beaker. Soak a few circles of a No. 1 Whatman filter paper all at a time, drain and allow to dry at 100°C in an atmosphere free from hydrogen sulphide. Cut into rectangular strips 25 × 5 mm each and keep them closed inside a clean dry glass-stoppered bottle.

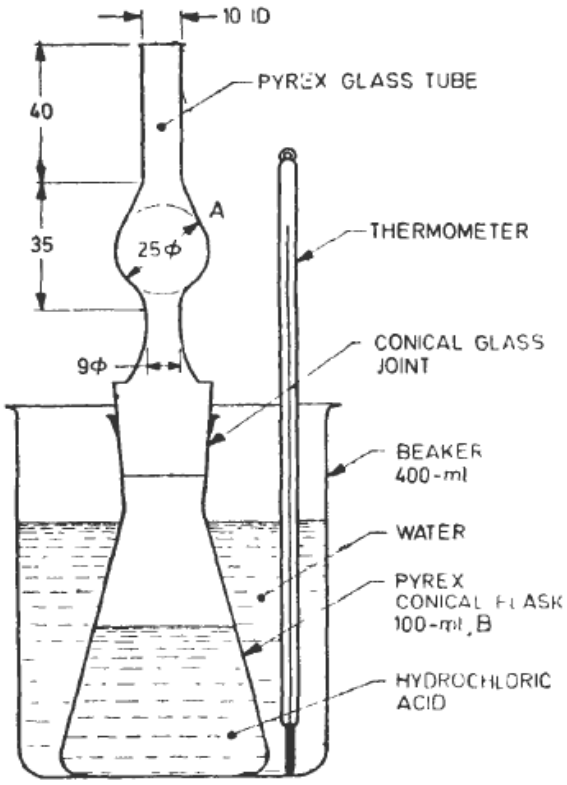
**C-1.2.3** *Hydrochloric Acid*

**C-1.2.3.1** Prepare 500 ml of 1:2 (*v/v*) hydrochloric acid, by diluting Analytical Reagent Grade HCl with twice its volume of water.

**C-1.2.4** *Zinc Analytical Reagent Grade in the Form of Granules*

**C-1.3 Apparatus**

**C-1.1.1** The set up of the apparatus for carrying out the test is as given in Fig. 1.




All dimensions in millimetres.

FIG. 1 APPARATUS FOR DETERMINATION OF SULPHUR

**C-1.4 Procedure**

**C-1.4.1** Transfer 5 g of the shredded and finely chopped material into the conical flask 'B'. Add 50 ml of the hydrochloric acid and allow it to wet the material thoroughly.

**C-1.4.2** Plug the tube 'A' with clean glass wool at the bottom of the bulb, place a strip of the lead acetate paper and plug the top of the bulb with glass wool.

**C-1.4.3** Keep the flask inside the beaker containing water, such that the water level comes nearly up to the neck. Adjust the temperature of water to 27 ± 2°C with the help of the thermometer adding cold water or warm water as necessary, clamping the flask if it tends to be buoyed up.

**C-1.4.4** Add 2.5 g of zinc and quickly fit the flask with the tube. Swirl the flask to ensure good mixing of the contents and adjust the temperature of the water as described in **C-1.4.3.**

**C-1.4.5** After the initial vigorous effervesence has subsided, keep the flask for 1 hour inside the beaker with the water maintained at 27 ± 2°C.

**C-1.4.6** At the end of period remove the paper strip and keep it inside a ground glass-stoppered moisture dish or test-tube or bottle.

**C-1.4.7** Carry out a blank using the reagents and procedures described in **C-1.4.1** to **C-1.4.6** except for the use of the material. If the lead acetate paper shows a perceptible stain repeat the blank with a different zinc sample or hydrochloric acid or water as the case may be and use only those reagents that give no perceptible stain.

**C-1.4.8** Prepare standard stains using 1 ml, 2 ml, 3 ml, 4 ml, 5 ml, respectively of the standard sodium sulphide solution adopting the procedure described in **C-1.4.1** to **C-1.4.6** except for the use of the material.

**C-1.4.9** Compare the stain produced by the sample with those produced by the standard.

**C-1.4.10** The material shall be taken as complying with the requirement if the stain produced by the sample is not darker than that produced by 5 ml of the standard sodium sulphide.

## C-2 DETERMINATION OF LEAD AND LEAD COMPOUNDS

**C-2.1 Procedure** — Weigh 10 g of the material in a silica basin, and ash it carefully until only slight traces of carbon remain. The temperature of the basin shall not be allowed to rise above faint red hot as at higher temperature some lead may be lost by volatization. Treat the ash so obtained with dilute nitric acid. The quantity of acid is immaterial provided it is sufficient to extract the soluble matter, but avoid too great an excess since it has to be evaporated off. Allow the basin to stand on a boiling water-bath for at least three hours. In case a large quantity of insoluble residue is felt, heat the basin on the water-bath over-night. Decant off the supernatant liquid through a filter paper and extract the insoluble residue again on a boiling water-bath for one hour with dilute nitric acid. Filter through the same filter paper and wash the residue thoroughly on the filter paper with hot water. Treat the residue on the filter paper with 10 ml of ammonium acetate solution, filter and wash again. Mix the filterate and washings in a 500 ml evaporating basin, and 2 ml of concentrated sulphuric acid and evaporate the contents of the basin on a sand-bath till fumes appear. Add 100 ml of water to the basin and allow to stand on the boiling water-bath for 15 minutes. Then dilute the contents to about 150 ml and allow to stand overnight at room temperature. Filter the insoluble matter on a No. 42 Whatman filter paper and wash thoroughly with dilute sulphuric acid. Transfer the filter paper and residue to a small beaker, cover with 20 ml of water and add 1 to 2 g of ammonium acetate. Heat the beaker on the water-bath for not less than half an hour, stirring the contents occasionally. Decant the liquid through No. 42 Whatman filter paper. Repeat the extraction with water and ammonium acetate. Transfer all the insoluble matter including the filter pulp to the filter and wash throughout with warm water collecting
the filtrate and washings in a 150-ml beaker. Pass hydrogen sulphide through the liquid for 10 to 15 minutes and filter the precipitated lead sulphide at once through a No 40 Whatman filter paper. Wash thoroughly but quickly with hydrogen sulphide water keeping the residue on the filter paper, if any, covered with liquid till washing is completed. Transfer the precipitate and filter paper to a tared silica-crucible. Dry, carefully ignite to sulphate, cool and weigh.

**C-2.2** Calculate the percentage of lead and lead compounds by the following formula:

$$L = \frac{W_2 - W_1}{W_S} \times 100$$

where

$L$ = percent, by mass, of lead;

$W_2$ = mass, in g, of silica basin with residue;

$W_1$ = mass, in g, of silica basin taken for testing; and

$W_S$ = dry mass, in g, of testing specimen taken for testing.

## ANNEX D
(*Foreword*)

## COMMITTEE COMPOSITION

Man-Made Fibers, Cotton and their Products Sectional Committee,
TXD 31

| *Organization* | *Representative(s)* |
|---|---|
| ICAR – Central Institute for Research on Cotton Technology, Mumbai | DR P. K. MANDHYAN (***Chairman***) |
| Ahmedabad Textile Industry's Research Association, Ahmedabad | SHRIMATI DEEPALI PLAWAT<br>SHRI JIGAR DAVE (*Alternate*) |
| Association of Synthetic Fibre Industries, New Delhi | SHRI M. S. VERMA |
| AYM Syntex Ltd, Dadra and Nagar Haveli | SHRI ARNAB SAMANTHA<br>SHRI SAUGATA DAS (*Alternate*) |
| Confederation of Indian Textile Industry, New Delhi | SHRI D. K. NAIR<br>SHRI SHAJU MANGALAM (*Alternate*) |
| Consumer Guidance Society of India, Mumbai | DR SITARAM DIXIT<br>DR M. S. KAMATH (*Alternate*) |
| Cotton Association of India, Mumbai | SECRETARY |
| Defence Materials and Stores Research and Development Establishment, Kanpur | SHRI ASHOK KUMAR YADAV<br>SHRI BISWA RANJAN DAS (*Alternate*) |
| Grasim Industries Limited, Vadodara | SHRI AJAY SARDANA<br>DR ROHITASVA KUMAR (*Alternate*) |
| ICAR – Central Institute for Research on Cotton Technology, Mumbai | DR SENTHIL KUMAR<br>DR A ARPUTHARAJ (*Alternate*) |
| JCT Limited, Phagwara | SHRI KHUSHWINDER SINGH DHILLON<br>SHRI ARWINDER SINGH (*Alternate*) |
| North India Textile Mills Association, Chandigarh | SHRI SANJAY GARG<br>SHRI SIDHARTHA KHANNA (*Alternate*) |
| Northern India Textile Research Association, Ghaziabad | SHRI SANJEEV SHUKLA<br>SHRIMATI NEHA KAPIL (*Alternate*) |
| Office of Textile Commissioner, Mumbai | SHRI SOURABH KULKARNI<br>SHRI PRANAV PARASHAR (*Alternate*) |

| *Organization* | *Representative(s)* |
|---|---|
| Reliance Industries Limited, Mumbai | SHRI AJAY GUPTA<br>SHRI KESHAV P PAAREEK (*Alternate*) |
| Textile Committee, Mumbai | SHRI J. D. BARMAN<br>SHRI P. N. S. SIVAKUMAR (*Alternate*) |
| The Bombay Textile Research Association, Mumbai | SHRI R. A. SHAIKH<br>SHRIMATI PRAGATI KULKARNI (*Alternate*) |
| The Cotton Corporation of India Ltd, Navi Mumbai | SHRI P. N. PILLEWAR<br>SHRI V. K. SINHA (*Alternate*) |
| The Cotton Textile Export Promotion Council, Mumbai | SHRI SIDDARTHA RAJGOPAL |
| The Southern India Mills Association, Coimbatore | SHRI D. SURESH ANAND KUMAR |
| The Synthetic & Rayon Textile Export Promotion Council, Mumbai | SHRI S. BALARAJU |
| The Synthetic and Art Silk Mills Research Association, Mumbai | DR MANISHA MATHUR<br>SHRIMATI ASHWINI A. SUDAM (*Alternate*) |
| Veermata Jijabai Technological Institute, Mumbai | DR (SMT) SURANJANA GANGOPADHYAY |
| In personal capacity (*D-618, Maruti Paradise, Sector - 15, CBD-Belapur, Navi Mumbai - 400614.Maharastra.*) | SHRI A. SATHEESAN |
| BIS Directorate General | SHRI J. K. GUPTA, Scientist E and Head (Textiles) [Representing Director General (*Ex-officio*)] |

*Member Secretary*
SHRI MAYUR KATIYAR
Scientist 'B' (Textiles), BIS

**Bureau of Indian Standards**

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

**Copyright**



**Review of Indian Standards**

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website-www.bis.gov.in or www.standardsbis.in.

This Indian Standard has been developed from Doc No.: TXD 31(18063).

**Amendments Issued Since Publication**

| Amend No. | Date of Issue | Text Affected |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

**BUREAU OF INDIAN STANDARDS**

**Headquarters:**

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

| **Regional Offices:** | | *Telephones* |
|---|---|---|
| Central: | 601/A Konnectus Tower-I, 6th Floor<br>DMRC Building, Bhavbhuti Marg, New Delhi 110 002 | 2323 7617 |
| Eastern: | 8th Floor, Plot No. 7/7 & 7/8, CP Block, Sector V<br>Salt Lake, Kolkata 700091 | 236 7012, 2320 9474 |
| Northern: | Plot No. 4A, Sector 27-B, Madhya Marg<br>Chandigarh 160 019 | 265 0206, 265 0290 |
| Southern: | C I T Campus, IV Cross Road, Taramani<br>Chennai 600 113 | 2254 1442, 2254 1216 |
| Western: | Plot No. E-9, Road No. 8, MIDC, Andheri (East)<br>Mumbai 400 093 | 28218093 |

**Branches:** AHMEDABAD, BENGALURU, BHOPAL, BHUBANESHWAR, CHANDIGARH, CHENNAI, COIMBATORE, DEHRADUN, DELHI, FARIDABAD, GHAZIABAD, GUWAHATI, HIMACHAL PRADESH, HUBLI, HYDERABAD, JAIPUR, JAMMU & KASHMIR, JAMSHEDPUR, KOCHI, KOLKATA, LUCKNOW, MADURAI, MUMBAI, NAGPUR, NOIDA, PANIPAT, PATNA, PUNE, RAIPUR, RAJKOT, SURAT, VISHAKHAPATNAM.

Publication Unit, BIS, New Delhi, India